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ABSTRACT

A Dallas County consortium study investigated use of the Control Data Basic Skills Learning System (computer-based education) as a means for providing a comprehensive, high quality program of individualized instruction in reading, mathematics, and language arts. It also examined issues related to the motivation of students whose training was subsidized by Comprehensive Employment and Training Act (CETA) funding and that of learners who sought training voluntarily. Participant and comparison groups were established at two sites. Comparison groups followed a course of instruction offered as part of the regular adult basic education program. Evaluation sought to compare effects of computer-based instruction in the basic skills with ongoing adult programs of literacy and cognitive skills improvement in the first year. The computer-based instructional program seemed to have no significant effect on the acquisition of basic skills for either CETA or non-CETA participants. Issues related to similar failures in CETA-funded projects were suggested, and specific recommendations were made about the conditions of learning which must be present and types of incentives necessary for the successful implementation of job skills training. (YLB)

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Abstract

This study investigated the question: Can computer-based education be used to develop literacy and mathematics skills in young adults so that they can pursue job and career opportunities that are not subsidized by agencies and the public and private sector? It also examined issues related to the motivation of students whose training was subsidized by CETA funding and that of learners who sought training voluntarily. In general the study did not yield the results the program administrators expected. The computer-based instruction seemed to have little effect on program participants. Discussion probes at issues related to similar failures in CETA funded projects and makes specific recommendations about the conditions of learning which must be present and the types of incentives necessary for the successful implementation of job skills training.

The concern for improved literacy in the United States has been well documented by articles in both the news media and scholarly journals. Statistics on the subject suggest that the problem of illiteracy has reached almost crisis proportions. This crisis affects every aspect of American life and is reflected in unemployment figures, increases in social welfare programs, and crime rates, particularly among juveniles. These effects serve as graphic testimony to the need for educational programs which will offer increased success at learning, closer correspondence of learning to the world of work, and instructional systems which will increase the probability of learner mastery of the basic skills.

In response to this growing national crisis, the Dallas County Consortium has used funds provided under CETA Title IV of the Youth Employment Training Program to explore a variety of alternatives which will enhance the job prospects and career opportunities of young persons to enable them to secure unsubsidized employment in the public and private sectors of the economy. Therefore, one of the objectives clearly inherent in the Consortium's mission is to provide effective training in the basic skills for youth seeking opportunities to learn skills which will lead to meaningful employment.

One alternative considered by the Dallas County Consortium was to explore the Control Data Basic Skills Learning System as a means for providing a comprehensive, high quality program of individualized instruction in reading, mathematics and language arts. This program has yielded dramatic results in CETA funded projects in the Adult Learning Center, Baltimore, Maryland and in "fairbreak" centers in St. Paul, Minnesota

(Rizza and Hunter, 1978). In the Baltimore project, for example, learners between the ages of 19-25 showed significant gains in both reading and mathematics achievement. In reading learners gained one whole grade level after only 32 hours of study. It is estimated that this same gain would require 150 hours in a traditional school setting. In mathematics learners gained 2.0 grade levels after only 24.3 hours of study. The traditional school equivalent for this gain would be 300 hours (Caldwell and Rizza, 1979).

The Baltimore project was also successful in that learners:

1. Indicated that computer-based instruction made reading easier, particularly because the computer could offer greater amounts of reinforcement and instruction on an individual basis than a teacher can in a typical classroom situation.
2. Expressed a preference for learning via the computer rather than in a class where their learning deficiencies were easily recognized by teachers and, more significantly, by other learners.
3. Favorably changed their opinions about reading and working with numbers.
4. Demonstrated an increased interest and self-motivation in regard to learning new things.
5. Expressed more self-confidence about success in testing situations.

These dramatic gains in achievement and attitude seen in the Baltimore project seem directly attributable to the unique characteristics of the Basic Skills Learning System. The system allows over 600 hours of instruction in mathematics, reading and language arts delivered through

the PLATO system of computer-based instruction. Learning is facilitated through a modularized network of computer-assisted lessons, drills and tests as well as through printed workbooks and videotaped presentations. The system offers advantages over other educational programs in that it is:

1. Totally individualized and offers a highly adaptive and responsive learning environment.
2. Modularized and structured in coherent behavioral patterns for flexibility and adaptiveness to learner needs.
3. Structured by intended learning outcomes carefully articulated in performance objectives.
4. Immediately diagnostic and prescriptive.
5. Responsive to learner needs, interests and abilities.
6. Multi-sensory in its approach to provide high interest, interactive instruction to each individual learner.

Project Summary

These encouraging results from the Baltimore Adult Learning Center and other CETA sponsored projects led the Dallas County Consortium to believe that the Basic Skills Learning System could contribute significantly to the Youth Employment and Training Programs in Dallas County. Therefore, they initiated a demonstration project to use the Basic Skills Learning System at two sites in Dallas County: the Wilmer-Hutchins Incentive School in Dallas and the Nicholson Memorial Library in Garland, Texas. These particular sites were chosen because both already conduct on-going basic skills instruction for disadvantaged youths and adults. Also, Wilmer-Hutchins Incentive School had been a CETA funded project for several years prior to this study.

Computer-assisted instruction in mathematics, English language arts and reading was provided to a group of randomly assigned students at each site for a period beginning April 1, 1979 and ending December 31, 1979. Comparison groups were also established at each site and followed a course of instruction which was offered as a part of the adult basic education normally received by students at these respective sites. Each of the four groups was composed initially of approximately twenty-five (25) learners set in the following configuration and possessing the following characteristics:

SITE I: Wilmer-Hutchins Incentive School

LEARNER CHARACTERISTICS

1. Low socioeconomic status.
2. High school dropouts between the ages of 16 and 21 and high school students who have not been able to conform to the traditional school setting.
3. Paid CETA participants seeking GED or high school equivalency credit offered through the Wilmer-Hutchins School District.
4. High concentration of minorities, particularly blacks.

INSTRUCTIONAL STRATEGIES:

Group I: Control Data Basic Skills Learning System.

Group II: Individualized instruction in reading, mathematics, social studies, and language arts. Instruction is scheduled on a variable time basis and delivered through use of learning contracts developed by the teacher in consultation with the student following learner diagnosis.

SITE II: Nicholson Memorial Library, Garland, Texas

LEARNER CHARACTERISTICS:

1. Low to low-middle income levels.

2. High school dropouts and postgraduates between the ages of 18-26 who are seeking high school equivalency through the GED test, entrance into the military or English as a second language instruction.

3. Voluntary participation.

4. Majority Anglo population from a "blue collar" orientation.

INSTRUCTIONAL STRATEGIES:

Group I: Control Data Basic Skills Learning System.

Group II: Individualized instruction which utilizes a wide variety of videotapes, self-paced materials, audiovisuals and text materials. Instruction is based on a variable time schedule and is prescribed on an individualized basis after instructor diagnosis.

RESEARCH DESIGN

The effects of the PLATO Basic Skills Learning System were compared with on-going programs of basic skills training which utilized a combination of multi-media based instruction, individualized and self-paced instruction, and teacher-led lecture/discussion approaches. Comparisons of the following variables were attempted:

1. Achievement

Pretest and post-test achievement was measured using the Adult Basic Learning Examination (ABLE); form A was used for the pretest and form B for the post-test. Both between group and within group comparisons were attempted for the experimental and control groups.

2. Time spent at instruction and its relation to achievement.

3. Attrition rate.

KNOWLEDGE DEVELOPMENT GOALS

The evaluation of the Basic Skills Learning System which was implemented at the Wilmer-Hutchins Incentive School and at the Nicholson Memorial Library sought to compare the effects of computer-based instruction in the basic skills with ongoing adult programs of literacy and cognitive skills improvement in the first year. It is hoped that long range effects of these programs could be measured in the future by the number of students from each group who:

1. Obtain high school diplomas through GED testing or through credit granted by the Wilmer-Hutchins School District.

2. Enter some form of continuing education such as further adult education, vocational training or higher education.

3. Find employment or who advance in their present jobs.

Beyond these basic requirements, it was hoped that learning experiences could be planned so that learners could (Wilson, 1978):

1. Develop a degree of self-confidence that will enable them to respond positively to employment opportunities and to adapt to the demands of jobs or training.

2. Develop a command of necessary life skills with particular emphasis on literacy and numeration.

3. Discover the type of work they like and begin to develop those skills associated with this work.

4. Improve their ability to learn and adapt to changing situations.

RESULTS

Table 1 presents a summary of the means and standard deviations of the ABLE subtest scores as a function of school and instructional method. Given the extensive missing data, a sequential data analytic strategy was necessary to explore potential school and instructional method effects.

Insert Table 1 about here

The first major analyses focused on posttest-only comparisons between the computer-based instructional groups and the individualized, contract method across the four ABLE subtests (math computation, math problem solving, reading, and spelling). In these analyses, the data were collapsed across schools since the small sample at the Wilmer-Hutchins' site ($n=7$) would render any school comparisons problematic. A proportionate number of these students (four in computer group; three in contract group) were included in the analysis and somewhat balanced out any potential school effects. The means, standard deviations, and F comparisons are presented in Table 2. As may be noted, none of the four one-way analyses

Insert Table 2 about here

of variance reached statistical significance. Both instructional methods showed similar achievement levels in computation, problem solving, reading, and spelling. Subsidiary analyses indicated a lack of pretest sensitization effects when the posttest scores of those students who had taken a pretest were compared with those that had not.

Table 1

Means, Standard Deviations, and Sample Sizes as a Function
of School, Instructional Group and Pre-Post Testing for the Four ABLE Groups

School/Instructional Method	ABLE Subtests			
	Math Computation	Math Problem Solving	Reading	Spelling
<u>Nicholson Memorial Library, Garland, Texas</u>				
<u>Computer Group</u>				
Pretest Mean	20.83	18.00	44.83	25.33
SD(n)*	9.50(6)	5.93(6)	5.84(6)	12.64(6)
Posttest Mean	19.46	20.25	45.31	25.64
SD(n)	10.64(13)	8.02(12)	6.29(13)	12.81(11)
<u>Self-Instruction</u>				
Pretest Mean	10.00	12.50	54.50	37.00
SD(n)	0(2)	14.85(2)	3.54(2)	0(1)
Posttest	19.76	25.35	44.36	27.67
SD(n)	7.53(17)	5.76(14)	9.27(22)	10.48(21)
<u>Wilmer-Hutchins Incentive School</u>				
<u>Computer Group</u>				
Pretest Mean	11.75	5.75	44.25	---
SD(n)	5.68(4)	2.99(4)	10.84(4)	---
Posttest Mean	9.75	6.25	40.50	---
SD(n)	4.35(4)	2.63(4)	8.58(4)	---
<u>Self-Instruction</u>				
Pretest Mean	18.00	3.33	40.67	---
SD(n)	6.24(3)	1.53(3)	3.21(3)	---
Posttest Mean	15.33	3.00	37.00	---
SD(n)	5.77(3)	1.73(3)	6.93	---

* The standard deviation is given first with the sample size noted within the parenthesis.

Table 2

Means, Standard Deviations, and F Comparisons Between the Computer-Based and Non Computer-Based Groups for the Posttest ABLE Students

ABLE Subtest	Computer-Based PLATO Group	Non-Plato Group	F	Significance Level
Mathematical Computation				
Mean	17.18	19.10	.44	Not Significant
SD	10.32	7.34		
N	17	20		
Mathematical Problem Solving				
Mean	16.75	21.41	1.86	Not Significant
SD	9.37	10.22		
N	16	17		
Reading				
Mean	44.18	43.04	.14	Not Significant
SD	6.92	10.74		
N	17	25		
Spelling				
Mean	29.60	28.83	.03	Not Significant
SD	13.38	10.46		
N	15	24		

The second series of analyses focused on changes in achievement as a function of any treatment. In these analyses, the data were collapsed across instructional method since the initial analyses indicated no differences between them. The means and standard deviations of the ABLE scores as a function of schools and pre-post testing are presented in Table 3. The independent variables were school and testing sessions (pre-post). For the computation scores, the 2 x 2 repeated measures ANOVA did not show any significant school or pre-post effects.

For the problem solving scores, a 2 x 2 unweighted ANOVA for repeated measures indicated that the Garland school students ($\bar{X} = 18.38$) showed higher achievement than the Wilmer-Hutchins ($\bar{X} = 4.78$) students. The pre-post problem solving scores were not found to differ and the school x pre-post interaction was also non-significant. In contrast, an unweighted means ANOVA with the reading scores did not indicate any significant school differences. The posttest scores ($\bar{X} = 42.12$) were found to be significantly lower ($F(1,13) = 10.05, p < .01$) than the pretest scores ($\bar{X} = 44.98$). Whether this represents a decrease in reading ability or just reflects ABLE form differences (Form A was the pretest; Form B the posttest) is unanswerable given the experimental design. The interaction was non-significant.

For the spelling scores, school effects could not be made since the spelling data was missing from the Wilmer-Hutchins students. A correlated t test between the pre- and posttest spelling scores for the Garland students was non-significant, however.

Table 3
Means, and Standard Deviations of the ABLE
Subtest Scores as a Function of Schools, and Pre-Post Testing

School	Math Computation	Math Problem Solving	Reading	Spelling
<u>Garland</u>				
Pretest Mean	19.28	16.62	47.25	27.00
SD(n)	9.59(7)	7.94(8)	6.80(8)	12.35(7)
Posttest Mean	23.00	20.12	45.25	27.42
SD(n)	11.79(7)	5.79(8)	7.89(8)	13.30(7)
<u>Wilmer-Hutchins</u>				
Pretest Mean	14.43	4.71	42.71	---
SD(n)	6.35(7)	2.63(7)	8.12(7)	---
Posttest Mean	12.14	4.86	39.00	---
SD(n)	5.43(7)	2.73(7)	7.50(7)	---

Time and Its Relation to Achievement

Data on time spent in instruction was available for a portion of the Garland students in the computer-based method only. Due to an administrative error at the Wilmer-Hutchins site, no time data is available. Average time spent on the PLATO Basic Skills Learning System is summarized in Table 4 for a small number of students. Average time spent for the contract, self-instructional groups were also unavailable.

Insert Table 4 about here

As may be noted, these students spent approximately 22 hours across reading, mathematics, and spelling instruction. The direction of the relationship between instructional time and achievement were somewhat surprising. For both reading and mathematics problem-solving there was an inverse relationship between time and achievement. In computation, time spent on instruction was positively related in the area of math computation. No relationship was noted in spelling. None of these correlations reached statistical significance, however.

Attrition or Enrollment

One advantage offered by the computer is accurate record keeping. At Nicholson Memorial Library we were able to determine how many learners entered the computer based program and how many completed the curriculum. Table 5 summarizes these data.

Insert Table 5 about here

Table 4

Average Time Spent by Nicholson Memorial Library on the
Computer Based Basic Skills Learning System and Its Relation to Achievement

	Average Time in Minutes	Standard Deviation	Correlation of Time with Posttest Achievement
Reading (n = 4)	366 (6.1 hours)	268.16	-.66
Mathematics (n = 7)	533.6 (8.9 hours)	446.9	+.61 For Computation -.70 For Problem Solving
Spelling (n = 7)	406.3 (6.8 hours)	184.2	-.04

Table 5

Attrition by Percent of Learners Who Completed the
Computer-Based Program at Nicholson Memorial Library

Curriculum	n	Percent Completing (by hours)		
		Under 2	4-6	6 or more
Math	27	52%	23%	25%
Language Arts	19	68%	10%	22%
Reading	12	62%	17%	17%

Table 5 indicates that over half of all learners entering the computer based basic skills program did not complete more than two (2) hours of instruction; conversely, only 25% or less completed a significant portion of the program. From these data, therefore, we must conclude that the attrition rate for the CBE program was 50-60%. Attrition rates for the self-paced instruction, which is the traditional form of basic skills instruction at Nicholson, also averaged about 60%. Program administrators had anticipated a much smaller attrition rate for the computer based curriculum, based on data obtained from projects which used the computerized Basic Skills Learning System. In one such project in Baltimore, Maryland, attrition dropped from over 60% under the old programs to less than 5% using the Basic Skills Learning System (Rizza and Walker-Hunter, 1978).

On-site coordinators at Nicholson Memorial Library noted, however, that only one individual dropped the computer-based program in favor of the self-paced, print-oriented program also offered there. Most students who dropped from the basic skills training program, therefore, whether they were enrolled in the computer based or self-paced programs, seemed to drop because they lacked the proper incentive rather than because they preferred one instructional approach to another.

Attrition rates at Wilmer-Hutchins Incentive School were undeterminable because of administrative errors which caused computer records to be deleted.

DISCUSSION

In general this project did not yield the results the program administrators expected it would. The computer-based instructional program seemed to have no significant effect on the acquisition of basic skills for either CETA or non-CETA participants. It was hoped that the CETA sponsored group

at Wilmer-Hutchins would show greater achievement gains because they were offered a financial incentive to attend this instruction and would, as a result, spend a greater amount of time at the instructional task. They neither spent more time at instruction nor gained greater skills. Instead, both the CETA and non-CETA groups were plagued by irregular attendance, lack of commitment to program goals, and failure to complete significant portions of the curricula.

A further disappointment of this project was that it was impossible to obtain complete data on the variables being examined. This was due largely to a combination of poor program administration and an inability to maintain on-going contact with the program participants at either site. At the Wilmer Hutchins site, for example, a large segment of achievement data and time-at-instruction records were deleted from the computer for reasons which still remain unknown. Also, regular contact with the program participants at both sites was impossible because of sporadic attendance.

The general conclusion that can be reached from these data is that financial incentives per se offered through CETA funded projects are not enough to maintain consistent attendance and instruction in Basic Skills Learning Centers. Instruction must be delivered as part of a broader based program which provides job skills or other rewards which are immediately realizable. At the Adult Learning Center in Baltimore, Maryland, for example, CETA participants experienced dramatic gains in reading and math achievement using the same computer-based curriculum offered in the project reported here. The difference in Baltimore students, however, was that they spent two (2) hours a day working at computer-based reading and math instruction and five (5) additional hours at clerical training. The basic skills instruction, therefore, was offered as part of a total job skills package which seemed to provide the added incentive to complete the basic skills curriculum.

In situations where proper incentives for acquiring basic skills are not provided, the process of teaching academic skills can become frustrating for both learners and program administrators. These incentives must be tied intricately to the conditions which contribute to the total instructional environment. These conditions include:

1. Learners must want to acquire skills. Without a desire on the part of the learner to pursue the acquisition of academic skills, all attempts at teaching become futile. A student's lack of desire to acquire these skills results from a complex tangle of forces which act on him/her over a long period of time. Most of these problems stem from a home environment where academic skills get infrequent use, where peers provide recognition only for non-academic achievements, and where role models work at jobs which require few formal academic skills. Reversing this pattern is difficult and no progress will be made in developing realistic youth employment opportunity programs without providing incentives that:

a. Provide opportunities to practice basic skills outside the school environment.

b. Create meaningful situations where applications of academic skills are critical to performance of work which gives the learner a sense of satisfaction.

In short, we cannot teach skills for which there is no real world application. Or, as Ralph Tyler points out (1976):

Skills quickly become inoperative when their use is infrequent. If the only reading required of youth is that assigned in school, reading skills do not reach a mature level. If writing is limited to an occasional note . . . letter writing skills remain very primitive . . . Hence, the total educational system should be reviewed as one in which practice as well as initial learning is provided (p. 112).

2. Learners must have an accurate perception of what they are learning.

Academic skill training becomes meaningful if learners have a clear sense of what they are learning and why they are learning it. The learning experiences which are provided must be directed at the experience base which defines the limits of the learner's present capabilities. Otherwise, the learner will not be able to comprehend the learning task and will become frustrated and discouraged.

3. Learners must take responsibility for a task and accept the consequences of success or failure in performing it. Learners must begin to learn this important lesson from the school experience. They seldom regard school or school assignments in the same way as they do work; this attitude only serves to widen the gap between the meaningfulness of skills learned in school compared with skills used in real world environments. Many students, for example, who entered the CETA program were not required to bear the consequences of not attending classes regularly. They continued to receive pay despite spotty attendance and token attempts at learning. Given this setting, it is little wonder that significant achievement gains were not made.

A second requirement of any computer-based instructional program is that it employ a full-time teacher who is committed to improving instructional performance and who is willing to take time to familiarize learners with this new form of instructional delivery. Too many teachers who administer computer based programs for the first time assume that the materials are "teacher-proof," i.e. they require no teacher intervention and are wholly motivational and complete in themselves. Computer-based materials must be integrated into a comprehensive educational program which provides both job skills and life skills so that the reading and mathematics take on larger significance as tools for improving one's ability to become financially responsible and socially productive.

In summary, while the CETA sponsored program described here yielded disappointing results, computer based instruction as a delivery system should not be discounted as a potentially effective means for developing basic skills. It can offer a number of advantages to adults in need of remedial education which compensate for many earlier learning problems. The motivational acceptance of the learning system is a result of extensive use of an interactive computer system integrated with a multi-media support package. This multi-sensory approach is often successful with students who have difficulty achieving in text-oriented, passive learning environments and carries with it a compelling novelty effect which most learners find extremely motivating. Also, the curriculum is individualized so that it adjusts learner progress in subskills by teaching to points of weakness and provides more opportunities for interaction and feedback than could be expected in a traditional classroom. Teaching for mastery insures large measures of success and builds student confidence and feelings of self-worth as they make progress through individual clusters. A multi-sensory learning environment provides a rich experience in which to learn new concepts and ideas. Finally, the modularized organization allows for flexible adaptation to a wide variety of learning needs and situations.

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